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ABSTRACT

This study explored the relationship between the occupational-educational background of engineering students and outcome after one year of college. The variables of ability, financial aid, part-time employment, and residence were explored to determine their effect on the relationship between occupational-educational background and outcomes. Results indicate that the ability level of the student demonstrated the strongest effects of the variables considered. Persistance and withdrawal rates were strongly influenced by ability level. High ability students more frequently lived in residence halls, received financial aid, and worked less than students of lower ability. Each ability group included students from a variety of occupational-educational backgrounds. (TL)

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VARIABLES RELATED TO OUTCOMES OF ENGINEERING STUDENTS OF DIFFERING OCCUPATIONAL-EDUCATIONAL BACKGROUNDS [1]

by

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The purpose of this study was to explore the relationships between the occupational-educational background of engineering students and outcomes after one year of college. The variables of ability, financial aids, part-time employment, and residence were explored and discussed as they affected the relationship between occupational-educational background and outcomes.

[1]Paper presented at American Personnel and Guidance Association Convention, Atlantic City, April 1971.

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VARIABLES RELATED TO OUTCOMES OF ENGINEERING STUDENTS OF DIFFERING OCCUPATIONAL-EDUCATIONAL BACKGROUNDS

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Description of Sample. The freshman student in the Institute of Technology entered with an excellent set of academic credentials. The average student began his first year of engineering studies with a high school rank (HSR) of approximately 86, and a Minnesota Scholastic Aptitude Test (MSAT) percentile score of 78. He had scored well on the ACT battery, with an average standard score of 22 on English, 30 in mathematics, 27 in social sciences, 29 in natural science and 27 on the Composite score. His overall grade point average in high school was approximately 3.2, with a 3.4 average in mathematics. Table 1 contains descriptive information concerning the 685 males of the 1969 I.T. freshman class included in the present study. An additional 40 males had parts of the occupational-educational background information missing and were not included in these analyses The 26 females in the class were considered as a separate group.

Summarizing briefly the descriptive information for the 1969 entering class, the predicted grade point average of 2.38 on a scale of 4.00 was based on a regression equation developed on the class of the previous year. The actual grade point average after one year for these students was 2.40, with an important one-fourth

of the class achieving at a rate lower than that required for a bachelor's degree. Approximately 65% of the students were in the persist group which registered for IT courses in the fall of the second year. Students who had transferred to another school of the University during the first year made up 16% of the group, with the remaining 19% of the first year students withdrawing from the University. The status of the withdrawing students with respect to attendance at other colleges was not known.

While one-third of the students in this group were living in University residence halls, the remaining two-thirds lived at home with their parents, in apartments, or in rooming houses. Slightly over one-half of the students did not work at part time jobs while attending school, 23% worked from 1 to 15 hours per week, and slightly more than one out of five students was employed 16 or more hours per week.

The financial aids program at the University of Minnesota combines scholarship and loan assistance with a work option which may be elected to reduce the amount of loan assistance. Slightly more than 15% of the students received scholarship assistance with an average amount of $450 for the school year. In addition, 14% of the students received loans with an average amount of $400, and the work option was elected by 4% of the students, replacing an average of $500 in loans.

Information concerning the father's occupation and the education of both the father and the mother was available from admissions data. Approximately 40% of the students came from homes where the father was employed in a managerial or professional occupation, with 30% of the fathers and 18% of the mothers having completed a college degree

or more. While a large proportion of the students came from homes of a relatively high occupational-educational background, 22% of the fathers were employed in skilled trades and 15% worked in service trades, unskilled trades, or other positions. In addition, 38% of the fathers and 51% of the mothers discontinued school after graduation from high school, and 18% of the fathers and 12% of the mothers did not graduate from high school.

This is the profile of the freshman male in the Institute of Technology considering the variables available. How were these different pieces of information related to the progress of these students as they experienced their first year of college?

Ability. One of the variables given frequent attention in the study of the progress of students in college is ability. In the present sample, students were divided into categories of low, middle, and high ability on the basis of their predicted grade point average. Students in the low ability group had a predicted GPA of 2.2 or lower, with students in the high ability group having a predicted GPA of 2.6 or above. The information presented in Table 2 indicates that this procedure split the group into three distinct levels of actual first year achievement, with related differences appearing in the outcome categories of persistence and withdrawal. Persistence increases with ability, withdrawal was higher for students of low ability, and the act of transferring was not as clearly a function of ability level.

The financial aids information indicated that the percentage of students receiving scholarships and loans increased as the ability level of the student increased. Hours of part-time employment

decreased as ability increased. The high ability student was also more frequently living in the residence hall.

The occupational-educational background information for the three ability groups indicates that there were only slight differences on these measures, suggesting little relationship between ability and occupational-educational background.

Occupational-Educational Background. A second variable to be considered is the occupational-educational background of the student's family. In the present study, a composite description of occupational-educational background (OEB) was formed by summing values assigned to the occupational level of the father and the educational level of the father and the mother. The OEB distribution was examined and three categories of OEB level were formed. Table 3 presents information about the students in these three levels of occupational-educational background.

Students in the low OEB category came from families where the father was most likely to be in a skilled or semi-skilled job, with less than 10% of the fathers and mothers having gone beyond a high school diploma. The high OEB group included students whose fathers were largely employed in managerial and professional positions, with over 80% of the fathers and 40% of the mothers having completed at least four years of college. It is significant to note that the relatively strong differences in occupational and educational backgrounds did not produce a corresponding set of differences in predicted grade point average. However, the high OEB students were achieving at a level somewhat higher than predicted on the basis of ability alone.

High OEB students were also more likely to persist and less likely to transfer or withdraw in comparison to students in the other two categories. Conversely, low OEB students demonstrated the lowest rate of persistence, the highest transfer rate, and a withdrawal rate approximately equal to that for students in the middle OEB category.

The percentages of students receiving financial aid was approximately equal in the low and middle OEB categories, with students in the low category receiving slightly larger dollar amounts. Students in the high OEB group received these awards less frequently. It is also apparent that students in the low OEB group spend more time at part-time employment during the school year. No consistent relationship between place of residence and occupational-educational background was found.

Ability and Occupational-Educational Background. It is important to consider the possibilities of interactions between ability and occupational-educational backgrounds. Did students of a specific ability level have differing outcomes which were related to the family background? Table 4 presents information describing outcomes related to the specific occupational-educational background within each of the ability levels.

Low Ability: Considering only the low ability students, it is apparent that the students in each of the OEB categories had similar predicted GPA's. However, while students in the low OEB category were receiving a higher number of scholarships proportionately, they were also spending more time in part-time employment than the middle and high OEB students of equal ability. The outcomes showed a lower achievement average and a lower persistence rate for students in the

low OEB group, accompanied by a higher proportion of students below a 2.0 GPA and larger proportion of students withdrawing from the University.

Middle Ability: Within the middle ability group, the low OEB student was working more hours per week, yet his achievement and persistence pattern was similar to the pattern for students of middle and high occupational-educational backgrounds. The low OEB students of the middle ability group showed a greater tendency to transfer with a related lower rate of withdrawal.

High Ability: Within the high ability group, both low and high OEB students showed achievement above predicted levels. While the withdraw rates were quite similar for each OEB group, the low OEB group showed a lower persist rate and higher percentage of transferring in comparison to high ability students in the middle and high OEB groups.

Employment, Residence and Occupational-Educational Background. Throughout this discussion, it may be noted that several references have been made to the amount of part-time employment. The consistent finding that students of lower ability and lower occupational-educational bakcground were working more suggests a need to study this variable as it relates to achievement and outcomes. In addition, it was decided to examine the effects associated with place of residence, with special awareness of the fact that residence hall students were offered the services of tutors in the areas of math and science.

Table 5 presents achievement, outcome, and financial assistance information for students of the three OEB categories, considering

differing combinations of residence and part-time employment load. It is important to note that the majority of the residence hall students indicated they were not engaged in part-time work, leaving small numbers of residence hall subjects in the 1-15 hours and 16 or more hours categories.

Non-Residence Hall Students: Considering non-residence hall students only, the grade point average for those low OEB students who were employed was lower than predicted, with GPA dropping lower as number of hours of work increased. Non-residence hall students of the middle and high OEB groups did not show this deficit until employment reached 16 or more hours per week. The outcome information for non-residence hall students indicated that within each of the OEB categories, the transfer rate for students who worked was greater than for those who did not work. Persist rates generally decreased and withdraw rates increased as employment increased for these students.

The drop in achievement and increase in the percentage of transfer, occurred when the low OEB student joined the group of working students. Middle OEB students did not show a clear boundary line, while high OEB students did not show an employment effect until the work load reached 16 or more hours per week.

Residence Hall Students: Within the residence halls, students for the low OEB group showed achievement above predicted for each of the work categories, and only students of the middle and high OEB groups who were employed 16 or more hours demonstrated achievement lower than predicted. The withdrawal rate increased in each of the OEB categories as the hours of employment increased. However, the

small number of residence hall students in the 1-15 hours work and 16 or more hours work categories made summary statements concerning the working student tentative at best.

SUMMARY

As expected, the ability level of the student demonstrated the strongest effects of any of the variables considered. Persist and withdraw rates were strongly influenced by ability level, and high ability students more frequently received financial aids, lived in residence halls, and indicated a somewhat reduced part-time work load in comparison to students of lower ability. However, each of the ability groups included students from a variety of occupational-educational backgrounds.

Examination of occupational-educational background levels indicated that while predicted GPA's for each category were quite similar, students of the high OEB group showed actual achievement higher than predicted along with the highest persist rate and the lowest transfer and withdraw rates. Students of the low OEB group experienced the lowest persist rate and the highest transfer rate, while indicating the highest average hours of part-time employment.

At each of the ability levels, it was found that the highest persist rate occurred for students of high OEB category with withdrawal and transfer rates generally being highest for students in the low OEB category. It was evident, however, that an increase in ability had a greater impact on outcome measures than did an increase in occupational-educational background.

The achievement of low occupational-educational background

students appeared to be moderated by ability level, with low ability students achieving below predicted and high ability students achieving above predicted. For the middle OEB category, middle ability students were achieving below predicted while for the high OEB category, high ability students were achieving above predicted.

Considering students who were not working part-time, residence hall students of each of the occupational-educational background groups showed an achievement advantage over non-residence hall students. The strongest negative influences on achievement and outcome measures associated with increase in employment were noted for students of low occupational-educational background

On the basis of the experiences of this class, it is expected that students who would have the most difficulty in this curriculum in the future would be the student of lower ability, who is from the lower section of the occupational-educational background distribution, who must work while attending school, and who cannot afford to live in the dormitory. It is apparent that this description fits many of the students who will be recruited in the near future through programs which desire to increase the opportunities for the "disadvantaged" student. To the extent that a developing program of this nature overlooks opportunities to build skills in pre-college and in-college programs while at the same time failing to reduce part-time work requirements to a minimum, it is to be expected that these recruited students as a group will continue to experience a disadvantage in terms of college academic achievement and outcome.

Any educational disadvantages in the past of the student which may have influenced his high school achievement or aptitude measures

will tend to remove the student from the high ability group which is most likely to receive scholarships under traditional standards of ability and need. The need for financial assistance will continue to exist and will show itself in an increased part-time work load which leads to a higher likelihood of lowered achievement and lowered persistence. This pattern is likely to continue until skill building and financial aids sufficient to reduce part-time work to a low level are combined in programs for disadvantaged students.

Table I

Description of Base Rates for
1969 Institute of Technology Freshman Males (N 685)

Achievement:	
Cum Pred GPA	2.38/.35
Cum Actual GPA	2.40/.76
Below 2.0 GPA	25.2%
Outcomes:	
Persist	65.4%
Transfer	15.6%
Withdraw	19.1%
Residence:	
Residence Hall	32.3%
Non-Residence Hall	67.8%
Employment:	
Not working	55.7%
1-15 hours per week	23.0%
16 or more hours per week	21.3%
Financial Aids:	
Scholarship	15.5%/$458
Loan	13.7%/$406
Work Option	4.2%/$509
Father's Occupation:	
Managerial, Professional	40.4%
Clerical, Sales, Farm	22.3%
Skilled Trade	22.3%
Service Trade, Unskilled, Other	14.9%
Father's Education:	
College graduate or beyond	29.8%
Some college or business/trade school	14.9%
High school graduate	37.7%
Less than high school graduate	17.7%
Mother's Education:	
College graduate or beyond	17.8%
Some college or business/trade school	19.3%
High school graduate	51.2%
Less than high school graduate	11.7%

Table 2

1969 Institute of Technology Males
Grouped by Ability Level

	Low Ability	Middle Ability	High Ability
Achievement:			
N	245	219	221
Cum Pred GPA	2.00	2.40	2.78
Cum Actual GPA	1.96	2.34	2.94
Below 2.0	46.4%	21.2%	5.9%
Outcomes:			
Persist	54.7%	63.6%	78.7%
Transfer	25.0%	18.9%	14.5%
Withdraw	21.3%	17.5%	6.8%
Residence:			
Residence Hall	27.3%	30.6%	39.4%
Non Residence Hall	72.7%	69.4%	60.6%
Employment:			
Average	7.8	6.8	7.0
Not working	53.7%	55.3%	58.2%
1-15 hours per week	25.0%	24.8%	19.3%
16 or more hours per week	21.3%	19.9%	22.5%
Financial Aid:			
Scholarship	7% 428	18% 413	24% 502
Loan	10% 502	15% 372	17% 371
Work Option	3% 663	3% 479	6% 436
Father's Occupation	5.9/2.5	5.9/2.6	6.1/2.6
Father's Education	4.1/2.1	3.9/2.0	4.4/2.2
Mother's Education	3.8/1.6	3.8/1.5	3.9/1.7

Table 3

1969 Institute of Technology Males
Grouped By Occupational-Educational Background

	Low OEB	Mid OEB	Hi OEB
Achievement:			
N	244	228	213
Cum Pred GPA	2.37	2.34	2.42
Cum Actual GPA	2.34	2.33	2.54
Below 2.0	29.9%	24.2%	20.9%
Outcomes:			
Persist	61.1%	64.3%	71.4%
Transfer	19.3%	14.5%	12.4%
Withdraw	19.7%	21.2%	16.2%
Residence:			
Residence Hall	32.4%	30.7%	33.8%
Non Residence Hall	67.6%	69.3%	66.2%
Employment:			
Average	8.3	7.0	6.2
Not working	51.6%	56.5%	59.6%
1-15 hours per week	23.7%	22.8%	22.4%
16 or more hours per week	24.7%	20.7%	18.0%
Financial Aids:			
Scholarship	20%/499	21%/429	6%/408
Loan	19%/400	18%/426	4%/338
Work Option	5%/567	7%/457	1%/550
Father's Occupation			
Managerial, Professional	.4%	39.0%	87.8%
Clerical, Sales, Farm	20.1%	34.7%	11.7%
Skilled Trade	43.9%	19.7%	.5%
Service Trade, Unskilled, Other	35.7%	6.6%	0.0%
Father's Education			
College graduate or beyond	.4%	11.9%	81.6%
Coll., bus., trade school	7.0%	24.1%	14.1%
High school graduate	52.1%	54.4%	3.3%
Less than HS graduate	40.6%	9.7%	0.0%
Mother's Education			
College graduate or beyond	.8%	12.7%	42.7%
Coll., bus., trade school	8.2%	25.4%	25.4%
High school graduate	66.0%	55.3%	30.1%
Less than HS graduate	25.0%	6.6%	1.9%

Table 4
1969 Institute of Technology Males
Grouped by Ability and Occupational-Educational Background

	Low Ability			Mid Ability			Hi Ability		
Achievement:	Low OEB	Mid OEB	Hi OEB	Low OEB	Mid OEB	Hi OEB	Low OEB	Mid OEB	Hi OEB
N	87	93	65	81	72	66	76	63	82
Cum Pred GPA	1.99	2.02	1.98	2.39	2.40	2.41	2.78	2.75	2.79
Cum Actual GPA	1.80	2.07	2.03	2.36	2.28	2.38	2.94	2.76	3.07
Difference	-.19	+.05	+.05	-.03	-.12	-.03	+.16	+.01	+.28
Below 2.0	59.3%	35.6%	44.4%	20.0%	22.5%	21.2%	6.7%	9.7%	2.4%
Outcomes:									
Persist	50.6%	53.3%	62.5%	61.7%	63.9%	65.5%	72.4%	81.0%	82.9%
Transfer	14.9%	15.2%	9.4%	23.5%	15.3%	17.2%	19.7%	12.7%	10.9%
Withdraw	34.5%	31.5%	28.1%	14.8%	20.8%	17.2%	7.9%	6.4%	6.1%
Employment:									
Average	9.1/10.3	7.6/9.7	6.2/9.1	7.7/9.5	6.2/9.4	6.3/7.7	7.9/10.0	7.1/9.0	6.2/9.7
Not working	47.2%	53.6%	62.8%	53.6%	60.7%	50.0%	54.8%	55.6%	63.6%
1-15 hours per week	27.8%	26.1%	19.6%	19.6%	21.3%	36.4%	22.6%	20.4%	15.2%
16 or more hours per week	25.0%	20.3%	17.6%	26.8%	18.0%	13.6%	22.6%	24.0%	21.2%
Financial Aids:									
Scholarship	10%/406	8%/521	3%/200	20%/469	24%/374	8%/370	32%/554	37%/441	6%/530
Loan	16%/521	11%/500	1%/250	18%/293	20%/457	6%/350	24%/389	27%/356	4%/350
Work Option	6%/610	3%/750		3%/700	7%/390		7%/470	11%/379	2%/550

Table 5
Achievement, Outcome, and Financial Assistance for IT Students
of Varying Residence, Part-Time Employment, and Occupational-Educational Backgrounds

		0 Hours Work		1-15 Hours Work		16 or more Hours Work	
		Res Hall	NonRes Hall	Res Hall	NonRes Hall	Res Hall	NonRes Hall
LOW	N	46	51	11	34	5	42
OEB	Pred GPA	2.47	2.35	2.55	2.32	2.52	2.32
	Actual GPA	2.65	2.46	2.65	2.22	2.65	2.14
	Difference	+.18	+.11	+.10	-.10	+.13	-.18
	Persist	78%	69%	64%	59%	60%	55%
	Transfer	15%	10%	18%	24%	0%	21%
	Withdraw	7%	22%	18%	18%	40%	24%
	Scholarship	24%	22%	45%	15%	60%	17%
	Loan	26%	24%	36%	18%	60%	14%
	Work Option	4%	4%	27%	3%	40%	0%
MID	N	46	61	8	34	4	34
OEB	Pred GPA	2.45	2.30	2.28	2.35	2.50	2.34
	Actual GPA	2.56	2.30	2.48	2.55	2.13	2.16
	Difference	+.11	.00	+.20	+.20	-.37	-.18
	Persist	72%	82%	75%	53%	25%	68%
	Transfer	22%	7%	0%	27%	25%	21%
	Withdraw	7%	12%	25%	21%	50%	12%
	Scholarship	41%	10%	38%	12%	0%	12%
	Loan	37%	10%	38%	3%	0%	12%
	Work Option	11%	3%	13%	3%	0%	0%
HI	N	46	50	9	27	2	27
OEB	Pred GPA	2.41	2.49	2.44	2.39	2.20	2.42
	Actual GPA	2.69	2.68	2.94	2.44	2.10	2.24
	Difference	+.28	+.19	+.50	+.05	-.10	-.18
	Persist	76%	82%	44%	82%	50%	46%
	Transfer	11%	10%	33%	11%	0%	23%
	Withdraw	13%	8%	22%	7%	50%	31%
	Scholarship	9%	2%	0%	0%	0%	15%
	Loan	4%	2%	0%	0%	0%	15%
	Work Option	2%	0%	0%	4%	0%	4%